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Keeping Chickens in Confinement

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OHIO
AGRICULTURAL EXPERIMENT STATION
Wooster, Ohio

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Fifteen years progressive development of the Experiment Station poultry research plant which serves Ohio's rapidly growing poultry industry

KEEPING CHICKENS IN CONFINEMENT

D C KENNARD AND R M BETHKE

Whether chickens should be kept in confinement, and just how far it is safe to go in that direction, is one of the keenest issues confronting many poultry keepers. It is a new question. Five years ago, **No**, without qualification, was the correct answer as to whether chickens, young or old, should be kept in confinement, because at that time it simply could not be done successfully. Now, in the light of our newer information relative to nutrition and management, we are obliged to right-about-face on this question. While much is yet to be learned before a positive answer can be given, the experimental evidence and phenomenal accomplishments in a practical way make the answer to this all important question today, **Yes**, rather than, no.

Methods of feeding and management of poultry are being rapidly revolutionized. Such changes are invariably due to the combination of factors, among which will usually be found a determining factor or force. In the present revolutionary phase of the poultry industry, the driving force is specialization, and the application of business principles and factory procedures. This necessitates intensification, which in turn must lead to keeping chickens in confinement. Or suppose one with a mind for business and factory efficiency were to apply the principles to poultry keeping. First of all, he would say that for a successful enterprise it must be of such proportions as to keep overhead to the minimum, to supply a volume of output such as can be marketed to the best advantage and permit the purchase of supplies and equipment at quantity prices. The accomplishment of these objects leads directly to intensification, which means confinement. As a result of the new and inviting opportunities offered by the poultry industry, business and factory minded specialists are finding it a field of promising opportunities. A modern hatchery is an example of intensification, which results from the application of business and factory methods, and efficient management.

A similar development, and a logical one to follow, is now taking place in the production of pullets and broilers. Everywhere, large modern brooding plants, where one specialist and a helper can properly attend to thousands of chicks, are rapidly replacing the

portable colony brooder plants, where the same help can manage but a few hundred chicks to less advantage. The demand today is for finished, ready-to-use products. Pullets past the need of artificial heat and taught to roost are sought by the majority of poultry keepers, rather than day old chicks. Brooding, of all the phases of poultry keeping, is the most hazardous for farm poultry keepers, because the small scale operations do not warrant proper equipment, or the needed experience and training, and brooding too often competes with other farm activities which may be given precedence. It will be a boon to farm poultry keepers when better pullets, ready for the summer range, can be purchased more economically than produced on the farm. This will certainly be a near-future accomplishment—great progress has already taken place so that many farm poultry keepers, and others, now have scrapped their old brooding equipment and are depending upon specialists, not only to hatch, but to brood their chicks. The portable colony brooding equipment will, no doubt, find itself in the same scrap heap as the small incubator in due time—the only difference being that the small incubator was the first to complete its mission. The same principles that eliminated the small incubator, are operating to cast aside the small brooding outfits.

WHAT IS MEANT BY CONFINEMENT?

There is every degree of confinement, but for the present purpose, by confinement, is meant the management of the birds so they are not permitted to come in contact with the soil. This involves a variety of procedures, such as confining the birds indoors on a floor, screened or unscreened. These indoor birds may also have access to an outdoor wire screen sun parlor, a cinder sun yard, or a concrete yard. Still another phase of confinement more intensified, is the keeping of chicks in battery brooders, or layers in batteries, or wire cages.

WHY CONFINE CHICKENS?

There are some sound basic reasons for the present trend towards keeping chickens in confinement.

One of the first reasons, previously mentioned, is the rapid development of commercial poultry keeping in all sections of the country. Another, and, perhaps, the most important reason, is to secure control of sanitation and the weather conditions. The latter is of vital concern to every progressive farm poultry keeper.

IS CONFINEMENT PRACTICABLE?

YES, but the best answer to this question is to cite how it has worked out in actual practice. So far as commercial poultry keeping is concerned, intensification with confinement is the only practical procedure. Colony laying and brooder houses and natural ranges are decidedly impractical for intensification, with the possible exception, in some cases, of the summer development of the pullets, and, perhaps, the breeders for the time being.

How about the farm poultry keepers? Again, actual practice gives the best answer. Much the same principles apply to the farm poultry flock, as to the large commercial flock, the difference being a matter of the degree of intensity. The greater the number of birds on a given area, the greater the skill of management and the attention to sanitation. A faulty condition of feeding or management with a flock of 200 birds may make no apparent trouble, whereas, the same condition with 1,000 birds on the same area might prove disastrous. The problem of disease prevention is as great with the farm flock as with the commercial flock. Many farmers have been obliged to raise their chicks in confinement, and confine the layers as a preventive of disease and intestinal parasites.

CONFINEMENT IN PRACTICE

Brooding chicks in confinement.—Since the advent of a complete ration, in 1923,* which serves the requirements of chickens confined indoors, the methods of brooding are becoming rapidly revolutionized. During 1910 to 1915, large capacity, hot water brooding plants became very popular. They proved a failure because of lack of information on feeding chicks indoors. After a few years, practically all the hot water systems were removed or dismantled. The discovery of the complete ration resulted in a prompt return of the hot water, or otherwise, heated brooderies, so that after five years they have become a standard type of equipment.

Within three years after the advent of the complete ration, twenty-five modern hot water brooding plants, varying in capacity from 2,000 to 5,000 chicks, were installed within the vicinity of Wooster.

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*The Nutrition Requirements of Baby Chicks, Wisconsin Experiment Station, Journal Biol. Chem. 1922, Vol. 52, page 379.

Rearing Chicks Indoors, Bimonthly Bul., Ohio Experiment Station, Jan.-Feb., 1924.

A Complete Ration Essential for Layers, Bimonthly Bul., Ohio Experiment Station, Nov.-Dec., 1925.

The Trend Toward Confinement in Poultry Management, Poultry Science, Vol. VIII, No. 1, Nov. 1, 1928.

These modern brooding plants added two new enterprises to the poultry industry—all-year production of broilers, and the production of January hatched chicks. January pullets have become popular with many poultrymen, because they seem to be less handicapped by disease and intestinal parasites, and have often proved more profitable than later hatched pullets. Rearing the chicks indoors has proved a boon to many farm poultry keepers as a preventive measure for disease, especially coccidiosis, and intestinal parasites. It is often impracticable or impossible to locate the brooder houses on clean soil each year, and yet, it is a poor business policy to attempt to do otherwise.

What is clean soil, and when is it clean? There is no satisfactory answer for this question. The safest procedure, in many cases, is not to let the chicks come in contact with the soil until they are ready to go out on the summer range, maintained for this exclusive purpose. This is a practical and pertinent suggestion for the farm, as well as the commercial, poultry keeper, because it is equally important that both make every endeavor to raise pullets free from disease and intestinal parasites, if they are to succeed. With present information on feeding and management, there is no question as to the practicability of brooding chicks indoors. In some ways, it is the easiest as well as the safest way.

One of the most successful farm poultry keepers near Wooster had made it a practice to confine his 200 layers in a 20 by 40 ft. straw loft house thruout the year. These layers regularly yielded a high winter and yearly egg production. The chicks and growing pullets had exclusive use of the outdoor range, and as the brooder house was a permanent one, they ranged over the same ground year after year. In spite of this, success attended the undertaking so that each year uniform first class pullets were put in the laying house. After fourteen successful years, disaster came. In the spring of 1927, everything seemed to go wrong with the chicks, so that practically none of the pullets were fit to put in the laying house in the fall. Apparently the cause of the trouble was coccidiosis and intestinal parasites.

Not willing to give up to a one-year failure after fourteen years of success, this man studied carefully how he might stage a "come back". He did not believe in brooding chicks indoors, but finding no other solution of his problem, he decided to try it for his 1928 chicks. He did so with less mortality and better success in general than before the range disaster. He used the 20 by 40 ft. laying house with straw loft and heated with coal stoves for a brooder

house, Figure 1. The chicks, hatched in April received no cod-liver oil, nor did they have access to a sun parlor. They received their exposure to direct sunlight thru open windows, when weather would permit. The feeding and drinking equipment was located just inside the windows, so that when the windows were open the chicks would secure their exposure to the unfiltered sunlight. These birds were never permitted outside, but kept as chicks, growing pullets, and winter layers in the quarters in which they started. They received cod-liver oil in the ration after November 1, but not before.

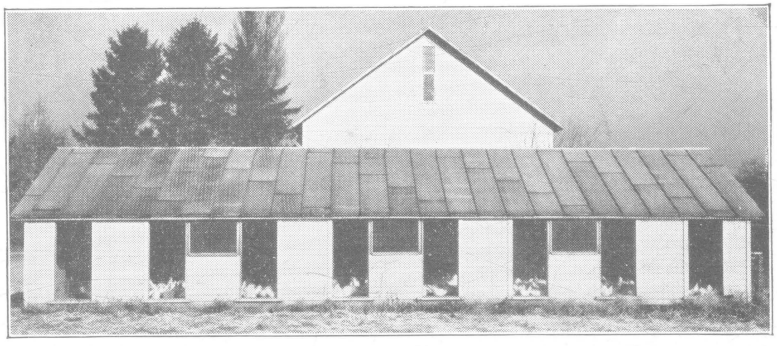

Fig. 1.—This laying house was used for brooding chicks in confinement. They were grown and continued as layers in these quarters. The feeding and drinking equipment was placed just inside the windows so as to insure exposure to sunlight, thus avoiding the use of cod-liver oil until November 1. This method of management proved highly successful.

At this time, June 1929, they are fourteen months of age. The mortality has been low, and egg production good. This poultryman is now convinced that he can succeed with his chickens in confinement, and that he can not afford to take the chance of using the outdoor range.

It might be well to emphasize here that neither keeping chickens in confinement nor any ration or method of management, can be expected to insure invariable success. Failure from other causes may result in spite of a complete ration or confinement of the birds under controlled sanitary and weather conditions and good management. These are but a few of the factors which must function properly for success, and they can lead to success only when the other essential factors will permit.

Confinement of layers.—Can the layers be successfully confined? **Yes,** if we are to judge from the results of experimental tests and large-scale demonstrations by many practical poultrymen.

The Ohio Station conducted a test in 1923-24 with 115 White Leghorn pullets confined indoors the entire year. This was before the use of cod-liver oil for feeding the layers. The birds received some (apparently ample) exposure to direct sunlight thru the open spaces in the south front of the house. The average production for the year was 161 eggs per bird, with a mortality of 4 percent. In a similar test the following year, with another group of pullets, the production was 166 eggs per bird, with a mortality of 18 percent. This high mortality the second year was largely due to an outbreak of bronchitis. Each year the pullets used in the tests were discards, which failed to qualify for use in the regular feeding experiments, and in spite of their inferiority, their egg production was normal, or above, for this strain of birds. The body weight was well maintained, and they were in good physical condition at the end of the year.

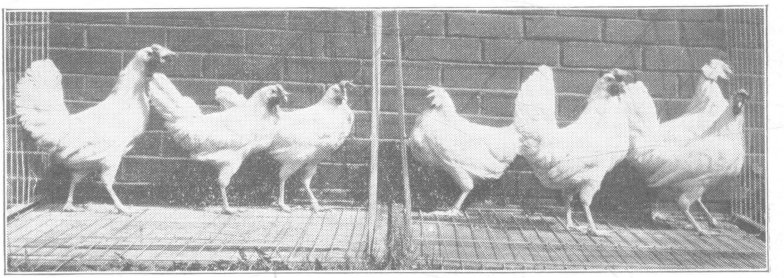

Fig. 2.—These birds had been in cages 30 inches square, with wire bottoms, two and one-half years when photographed. Three of the birds are still alive and laying, June, 1929, four and one-half years after beginning the test. One of the surviving hens laid 80 eggs from December 12, 1928 to June 1, 1929. At this time she is 5 years and 2 months of age.

While these tests of one year's duration were successful, we wondered what a hen's endurance might be for confinement indoors where all direct sunlight was excluded. In the fall of 1924, or about as soon as information was available for the preparation of a complete ration, or a ration which would meet indoor requirements, the Ohio Station began a laboratory test with two groups of four White Leghorn pullets in each. They were placed in wire cages 30 inches square, Figure 2, with bottoms made of ½-inch mesh hardware cloth, and without roosts or nests. The receptacles for mash,

water, and oyster shells were placed outside the cages. The all-mash feed for Group 1 was composed of equal parts of ground corn, ground oats, and wheat middlings (shorts), to which was added 7 percent meat meal (75 percent protein), 2 percent mineral mixture (composed of poultry bone 60, ground limestone 20, and salt 20), alfalfa leaf meal 5 percent, and cod-liver oil 2 percent. Group 2 received the same ration, with 14 percent of the meat meal. The pullets in Group 1 laid 104, 79, 78, and 67 eggs, respectively, per bird for the first four years. Those in Group 2 laid 116, 86, 71, and 41 eggs. Group 1 laid 54 eggs to June 1 of the fifth year. The one remaining hen in Group 2 laid 80. The total eggs per bird for the four and one-half years for Group 1 being 382, and for Group 2, 394. The first bird to die was in Group 1, the second year. With this exception, the birds in both groups lived until the fourth year, when a second death occurred in Group 1, and three deaths in Group 2, leaving two in Group 1, and one in Group 2 June, 1929, four and one-half years after the beginning of the test. The age of the remaining birds is slightly over five years, since they were hatched in the spring of 1924. The mortality during the first three years was one out of eight, or 12.5 percent. This can be considered low, as compared with flocks kept under usual conditions. Body weight was well maintained. The birds laid large, strong shelled eggs, so that very few were broken, even tho laid on bare hardware cloth where the birds could step on them.

When this test was started in 1924, it was hardly expected the birds could long survive under the laboratory conditions. Success with chickens indoors was a new accomplishment at that time, and we still thought in terms of the near past when such attempts invariably proved futile, owing to lack of information as to a complete ration for indoor requirements. For this reason pullets unfit for use in any other feeding test were used. Since these inferior pullets did so surprisingly well the first year, we wondered what selected pullets might do. Accordingly, beginning in 1925, a year later, the test was repeated with two groups of four selected White Leghorn pullets.

Group 1B laid 135, 98, and 66 eggs per bird during the first three years, and Group 2B laid 146, 99, and 67. The fourth year, to June 1929, 1B laid 20 eggs per bird; and 2B, 36. The total for the three and one-half years being 319 and 348, respectively. One bird died in lot 1B the first year. This was the only loss during the three and one-half years, which was again above the life expectancy of hens kept under usual conditions.

A third laboratory test, involving two groups of four layers in each cage, averaged 120 eggs per bird the first year. One bird from each group died during the latter part of the year.

A practical test in progress at the Station's poultry plant involves three groups of 100 White Rock pullets. Each group has a 20 by 20 ft. floor space in a poultry house, and is fed and managed the same, except in the matter of confinement. Group 1 has access to an 8 by 20 ft. wire screen sun parlor (Fig. 3, middle) on the south side of the house. Group 2 has access to about ½ acre of a blue grass range, and Group 3 is confined indoors, with little exposure to direct sunlight. All receive 1 percent of a tested cod-liver oil in the all-mash feed, and chopped alfalfa hay. This test involves a three-fold object. First, if layers receive a potent cod-liver oil and alfalfa, will exposure to direct sunlight prove beneficial? Second, does a green range prove beneficial in addition to an otherwise complete ration? And third, does a blue grass range beneficially supplement alfalfa and a wire screen sun parlor? The average winter egg production from October 1 to March 1 was 65, 56, and 64 eggs per bird for the sun parlor, blue grass range, and indoor groups, respectively. The average to June 1 was 92, 88, and 101 eggs. The mortality was 15, 26, and 35 percent. Whether the greater mortality in the range and indoor groups is significant or not, will have to be determined by repeated tests.

Still another type of confinement is being tested. June hatched day-old chicks were placed in a brooder house floored with ½-inch square mesh hardware cloth. The pullets, now a year old, have remained in the same quarters unchanged, except for the removal of brooder stove, and the installation of roosts and nests. They have access to an outside wire screen sun parlor, Figure 3, bottom. These June hatched pullets laid at the rate of 52 percent in December, 61 in January, 56 in February, 51 in March, 40 in April, and 44 percent in May.

The mortality of the chicks was above normal, owing to the poor quality of chicks and faulty management. The mortality of pullets from November to June was 20 percent. Some of this was due to lameness and paralysis. Hence, wire inside and outside cannot always be expected to prove effective as a preventive of such complications, altho in many instances it may prove beneficial. The only difficulty encountered was that the birds contracted the vice of feather eating. This, apparently, did not affect egg production, and while it did not develop into cannibalism, it did mar

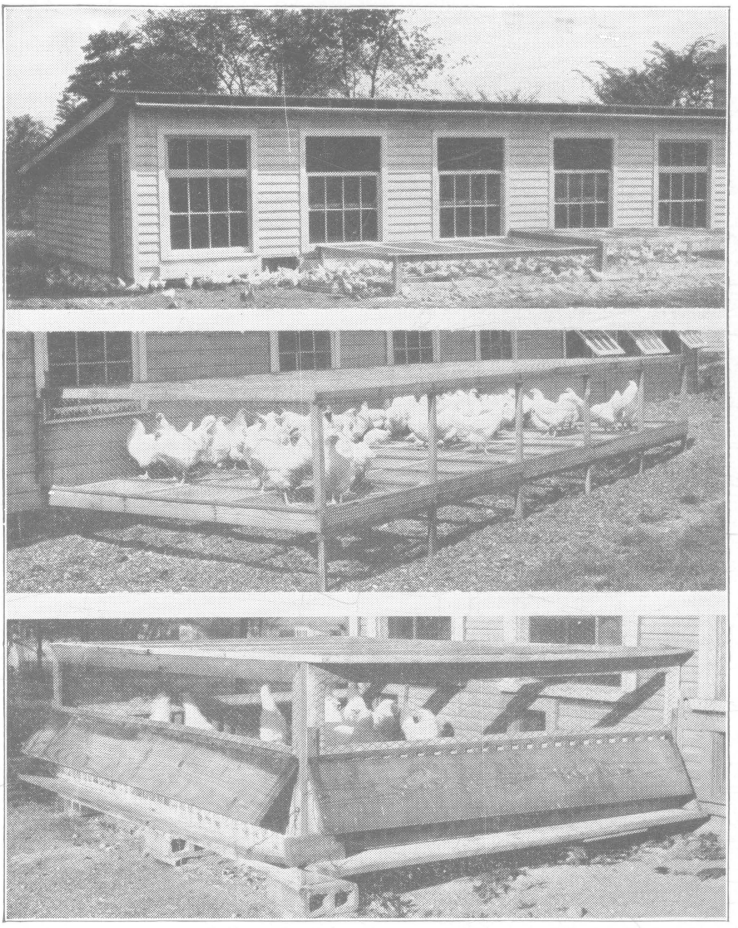

Fig. 3, top.—A test in progress at the Station with chicks on range (left), in slag sun yard (middle), and in screen sun parlor (right).

Middle.—A wire screen sun parlor for layers. In this case, instead of feeding outside, the birds are driven out into the sun parlor and kept outside for one-half hour daily at noon, when weather permits in winter, and at 8:00 A. M. or 4:00 P. M. during summer months, so that every bird will receive the benefits.

Bottom.—June, 1928, chicks started on wire screen floor in brooder house and continued as layers in the same quarters to June, 1929. Their egg production averaged 50 percent from December 1 to June 1. When the birds receive all feed and water outside they need to be protected against the hot sun during summer months. Single thickness burlap stretched over the top of sun parlor will serve this purpose, and admit sufficient direct sunlight.

the appearance of the pullets. This is not a serious matter, however, for the vices of feather eating and cannibalism are preventable by proper management.

The many problems involved in the confinement of chicks, developing pullets, layers, and breeders, and the various phases and possibilities for its practical application, are regarded as a major subject for research by the Ohio Experiment Station. A number of phases of the subject are now receiving attention, and with the better and more adequate working facilities now available at the Station, it is expected that more work can be undertaken, and that better progress will result.

The subject, with all its ramifications, is so large and new that its ultimate possibilities cannot at present be fully visualized. It is now in the speculative stage. The next development should be to get further information. For instance, we have the battery brooders, but the needed information on the feeding and management of the chicks is yet to be determined. Some other questions are: If chickens have access to sun parlors should they also receive cod-liver oil? If cod-liver oil and legume hay are fed will any benefit result from the use of a sun parlor or green range? What diseases and internal parasites may be avoided by confinement? Will confinement best apply to chicks, developing pullets, layers, or breeders, or can it be applied equally well to all? Can legume hay be used as a complete substitute for succulent green feed? Why do some chickens contract the vices of feather eating and cannibalism, while others of the same kind and age and receiving the same feed and management do not? Is it a question of management, such as too much light, overcrowding, too much heat, a faulty or deficient ration, an intestinal disorder, or lack of roughage? These are but a few of the questions involved in the subject of confinement, any one of which may be made a fundamental research problem.

TREND TO CONFINEMENT WIDESPREAD

The trend towards confinement is in evidence from coast to coast. Pennsylvania State College for the last two years has confined chickens, beginning with day-old chicks, and including the layers and breeders. This radical departure from customary practices was necessitated as a measure for prevention of disease and intestinal parasites. The College reports successful growth of chicks, with a low rate of mortality, and that the pullets, being comparatively free from disease and intestinal parasites, entered

the laying houses in good condition, followed by better egg production and less mortality. Furthermore, what may be regarded still more remarkable, is that the breeders under the same conditions produced eggs of good hatchability, which in turn yielded vigorous chicks. The breeders have access to small outside concrete yards inclosed with fly screen to exclude flies, which are regarded as one of the principal carriers of tapeworm infection. The laying and brooder houses were also protected against flies.

For a number of years the University of California has found the concrete yard a valuable aid against disease and internal parasites. The birds on their new poultry research plant at Berkeley, with an ultimate capacity of 12,000 chicks, and 6,000 mature fowls, are being confined to concrete yards, so all contact with soil will be avoided.

In New Jersey, many of the large poultry farmers have confined their birds indoors to avoid the menace of the range. Upon visiting a number of the commercial flocks of 5,000 to 10,000 layers in the summer of 1928, we observed that many poultrymen had resorted to confinement of the layers all the year, and they seemed pleased with the innovation, because of the benefits resulting from abandonmnt of the contaminated yards. Two instances of many will be briefly related.

Birds in the Vineland Egg Laying Contest were confined in small colony houses. We were told that it happened as follows: In 1926 it became necessary to renew the fencing and reseed the yards. The undertaking was such that it was impossible to complete the work so as to permit the 1926-27 contest birds out on the ranges. The birds did so surprisingly well inside, that they were kept confined the whole year, with the result that it proved one of the most successful of the many years this contest has been in progress. The contest birds have since been confined, with satisfactory results.

The second instance was that of a commercial poultry farm of 70 acres carrying 10,000 layers. The farm was equipped with twenty-three colony laying houses, 20 by 80 ft. so located that each colony had a range independent of the others. A few years before, this plan was generally considered the most ideal layout for a large commercial poultry plant, so far as range is concerned. But after a few years, we find all these ranges abandoned to tall grass and weeds, and inside the houses thousands of apparently happy and profitable layers. Why? Because the range failed to meet requirements and proved instead a trouble maker. This was the

second year the layers had been confined, and it was said that much improvement had resulted, and it was expected that the elaborate yarding system would not again be used.

This rapid trend towards keeping chickens in confinement is based on the operation of fundamental principles. Surely we need no longer question the fact that layers can be held in confinement successfully for two years or longer. If so, this means that many large scale poultry plants are antiquated. Compare a poultry plant carrying anywhere from one to ten thousand, or more, layers in colony houses scattered over a corresponding area for sake of range, with the layers confined inside all the year because of the menace of range conditions, to a modern poultry plant compactly designed for keeping the birds in confinement. A 50 by 80 ft. four-floor building, properly arranged, would nicely accommodate five to six thousand layers. Consider the economy of construction, maintenance, and labor that would result; the effective control of ventilation, temperature, and sanitation that could be secured; and the advantageous use of conveniences and labor saving devices and equipment that would be made possible. Can any poultryman with 500 or more layers longer afford to sacrifice these advantages for the uncertainties attending the use of an outdoor range?

With the present information on feeding and management and the proper use of wire screen sun parlors, does the commercial poultry keeper of today have need for an outdoor range? There is no positive answer as yet, but judging from the experimental evidence available, and the experience of poultry keepers thruout the country, it seems safe to say that the general practice of commercial poultry keepers in the future will be to brood the chicks in confinement and confine the layers and perhaps the breeders. The summer development of pullets may be in confinement, or they may be on a summer range, used exclusively for that purpose. In fact, many progressive poultry keepers are now following this procedure.

As to the farm poultry keepers, the time is near when the majority will likely purchase their pullets ready for summer range, instead of day-old chicks. When these pullets go into laying quarters they will, in most instances, be confined. In the meantime, the farmer who raises 200 chicks or more a year, may often succeed better if the chicks are brooded in confinement.

BARNS AND MULTIPLE FLOOR POULTRY HOUSES

Keeping chickens in confinement is revolutionizing poultry and brooder house construction. Already poultry houses of two or more stories have passed the novelty stage. One Ohio poultryman

has a six story, sky scraper poultry house to accommodate thousands of layers. Many of the large, well-built, and commodious barns in Ohio, not being used as originally intended, are being converted into poultry houses, Figure 4. It is a comparatively simple and inexpensive matter to convert these barns into two, three, or four floor poultry houses, so as to accommodate from 500 to 1,000 or more layers. A barn for poultry, if properly remodelled, is preferable to a poultry house as usually built, because the barn house is usually built so much more substantially and offers greater protection against the weather, both winter and summer.

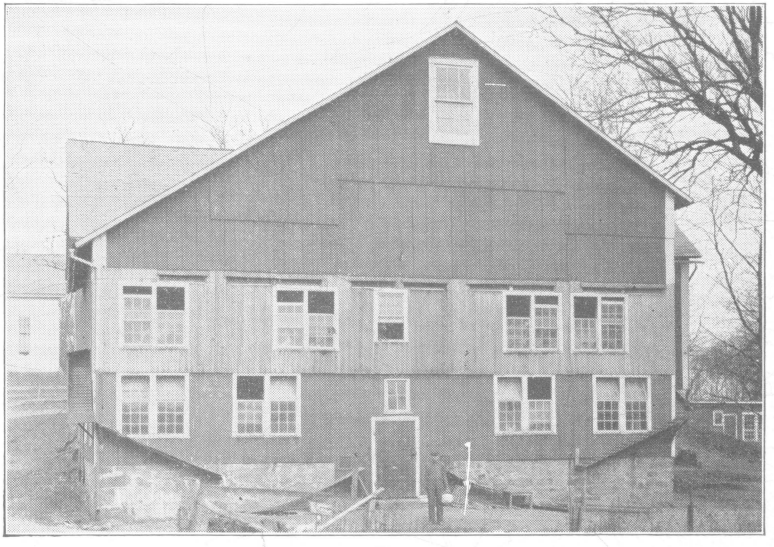

Fig. 4—A typical Ohio barn, a portion of which has been converted into satisfactory quarters for layers. Note the outside runways for hens to come from second floor to outside range. They have never been used because they are not practical, and, besides, the hens were better off inside. When the owner remodeled this barn four years ago, he supposed it would be necessary to range the layers outside, but he found it was unnecessary and impracticable. Many barns might be used effectively for housing poultry. To build a new poultry house when a good barn is available is poor business economy.

CONVERTING A BARN TO POULTRY HOUSE

Each barn is a separate problem. There are some general suggestions which apply in most cases. The height of ceiling from floor for poultry quarters is generally seven feet, the depth may be from twenty to forty feet for a south front, and the length indefinite. If the poultry quarters face east and west, the width

may be greater. For instance, a barn 60 ft. wide could be made into two poultry sections 30 ft. wide, one facing east and the other west with a solid partition between, where the roosting quarters would be located. The length would depend upon the space available or desired for the number of birds to be accommodated.

As to direction of exposure, south and east are much preferable to west. Both south and east are good, each having its advantages and disadvantages. In many cases, there is no choice and no need for further concern. However, if one has a choice between a south and an east exposure, he should consider the advantages and disadvantages of each. Some of the advantages of the east front are less exposure to prevailing winds and storms (with certain exceptions, owing to location), better morning light, and better exposure of birds to direct sunlight from February to December, as the morning sun will penetrate far into the house for a considerable time. It is this morning sunlight that the birds appear to enjoy most. Because the morning sun is less severe, the birds will bask in it with comfort for a much greater length of time, receiving ample ultra violet rays even tho these rays are less abundant in the morning.

The south front may have some advantages over the east front in December and January, when the sun is far south from morning till night. However, this advantage is more than discounted by the east front during the other ten months; so it is a question of two months against ten months, in favor of the east exposure. In summer, the south front has a distinct disadvantage because the sun's rays are so nearly vertical that little direct sunlight gets into the house

The arrangement of windows and ventilation of poultry quarters in barns may be much the same as for regular poultry houses. Ample feed storage may be provided on the top floor, and arranged to feed by gravity thru chutes to the other floors. Likewise, a chute leading from each floor is needed for disposal of litter. A convenient means of securing fresh litter is important, and water under pressure on each floor is a necessity.

Whether it is a barn, or a multiple floor house, some effective means for exposure of the birds to direct sunlight is essential, if the establishment is to prove fully successful. Probably a suitable sun parlor can be arranged for the upper floors. Otherwise, the proper arrangement and utilization of the windows and open front space so as to admit an abundance of direct sunlight when weather permits, may serve the purpose, and with careful management, may

be made highly effective. Particular emphasis is given this point because this type of housing involves the keeping of chickens in strict confinement, with no chance at ranging outside, except in small sun parlors.

CONFINEMENT REQUIRES A COMPLETE RATION

A complete ration and keeping chickens in confinement are inseparable. The term "complete ration" suggests a ration adequate or complete for all requirements. It may be regarded as the balanced ration plus green feed and direct sunlight, or their equivalents, Figure 5. A balanced ration has the proper balance or proportion of proteins to fats and carbohydrates. Such a ration proves satisfactory when completed, as in nature by a green range and the direct sunlight which goes with it. When the birds are confined indoors, the poultry keeper must assume entire responsibility for providing a complete ration. That is, in addition to the usual ration made up of grains and their by-products, protein concentrates, and minerals, green feed and direct sunlight, or their equivalents, must be provided. When succulent green feed is not available, high quality, leafy, green alfalfa, clover, or soybean hay can be used instead, Figure 6.

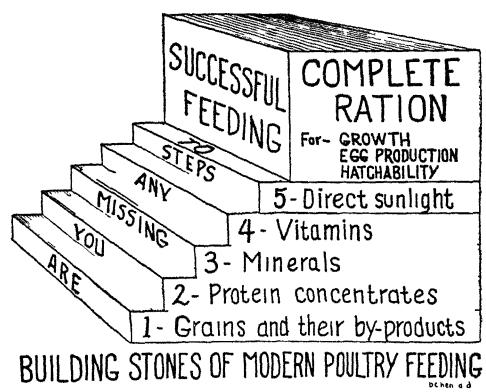

Fig. 5.—A graphic representation of the complete ration which has overcome many of the former impossibilities in poultry keeping. Its development has enabled the successful confinement of chickens of all ages. The complete ration is the balanced ration (proper proportion of proteins to carbohydrates) plus adequate minerals, the vitamins of green feed or of special quality legume hay, and direct sunlight or its equivalent.

When direct sunlight is not available, or when weather conditions prevent its utilization, a potent cod-liver oil, or its equivalent, may be substituted to advantage. By direct sunlight is meant outside sunlight, or sunlight that passes unfiltered thru open space into the poultry house. Sunlight passing thru ordinary glass is impotent for the vitamin D factor, which is such an essential part of the complete ration. Certain glass substitutes permit some of

Fig. 6.—These layers are eagerly completing their otherwise deficient (balanced) ration by eating alfalfa hay and at the same time absorbing the vital properties of direct sunlight, which is one of the most essential parts of the complete ration.

the ultra violet rays to pass thru. In some instances light thru glass substitutes may serve as a partial substitute for direct sunlight or potent cod-liver oil. With ample direct sunlight, it may not be of any advantage to use cod-liver oil; but in many cases the use of both, particularly during the winter months, may prove more effective.

SUN PARLORS AND SUN YARDS

Confined birds may often be benefitted by the outside exposure to direct sunlight even if considerable direct sunlight enters the house, or if the ration carries a potent cod-liver oil. Direct sunlight is the best and most economical source of the vitamin D factor, which is essential for the welfare of the birds. Every effective means, therefore, should be employed for utilizing it to advantage. That is the purpose of the outside sun parlor. It permits getting the birds outside in the direct sunlight without their coming in contact with contaminated soil. This is taking advantage of the best factor afforded by the natural range without incurring its hazards. Where a considerable number of chickens are kept, often the most important function of the natural range is the exposure to direct sunlight it affords the birds. As a source of adequate green feed, it often fails.

The wire screen sun parlor is an outside inclosure next to the brooder or laying house. It is usually about half the area of the

floor inside. The frame for bottom is made of 1 by 4 inch boards set edgewise, and spaced 2 ft. apart. This is covered with ¾ inch square mesh hardware cloth, made of Number 15 or 16 gauge wire*, 24 or 48 inches wide, the narrow width being preferable. This size mesh is satisfactory for both chicks and hens. One-half inch mesh wire is not satisfactory for either. The frames may be made in sections, the size depending upon the number of birds to be accommodated. For a 10 by 12 ft. brooder house, a frame 6 by 8 ft. is used. In case of a sun parlor for layers in a 20 to 24 ft. width poultry house, Figure 3, middle, the frames may be made in sections 8 or 10 feet wide, and 10 to 12 feet long. Front and end panels are 24 inches wide, and made of 1 by 3 or 4 inch strips, covered with 1 inch mesh poultry netting. The top panels may be made 2, 3, or 4 feet wide. The front top panel is hinged so it can be opened easily when desired. If flies are to be excluded, the sun parlor must be enclosed tightly around the bottom and covered with fly screen, instead of 1 inch mesh poultry netting. Of course, the house will then have to be screened against flies. The floor of the screen sun parlor may be placed 10 or 12 inches above ground, so the droppings can be removed by a scraper. Or the frame can be set close to the ground, and removed during the process of cleaning.

To insure that all the birds take advantage of the sun parlor, they should be fed and watered in it, or be driven into it regularly once daily and shut in for a half hour, besides having a chance to go out when they please. If it is desired to feed and water the birds in the sun parlor, the side and front panels can be slatted with plaster lath so they can reach thru to feed and water outside the inclosure, Figure 3, bottom. The mash troughs are protected from rain by slanted boards, hinged so as to turn up when feed is being put into troughs.

A sun yard is an outside yard, inclosed the same as the sun parlor, but instead of the screen floor, the ground is covered with 8 to 12 inches of cinders, slag, or crushed stone to prevent the birds from coming in contact with the soil, Figure 3, top. The material used should be coarse enough so as to permit the rain to filter thru readily, and at the same time, carry away the soluble part of the droppings. The difficulty with this plan is that the filling material will likely need to be removed and renewed yearly. Some poultrymen cement the bottom of sun yards, but a cement yard is not satisfactory in that it is supposed to be washed, scrubbed, and

*If this material cannot be secured locally, write for names of firms that can furnish it.

disinfected daily, which is seldom done. Furthermore, the cement yard may require the use of litter to prevent the birds from contracting the habit of eating the droppings.

BOTH SIDES OF CONFINEMENT

Altho keeping chickens in confinement has many undeniable advantages, and offers the only effective solution of many problems and difficulties, especially for the commercial poultry keeper, or the farm poultry keeper whose flock is seriously troubled with disease and internal parasites, the disadvantages of keeping chickens in confinement should not be overlooked.

To begin with, the brooding of chicks and development of pullets in confinement, require more exact feeding and management. The chicks or pullets must have a complete ration, in spite of this, they will be more subject to the vices of feather eating and cannibalism, which are probably the greatest disadvantage and liability to be encountered when one undertakes to keep chickens of any age in confinement. However, the prevention and control of these vices is a matter of proper management, or knowing what to do and how to do at the right time, an accomplishment which must be learned largely by experience.

So far as the layers are concerned, if they have been brooded and developed without having contracted the vices of feather eating and cannibalism, there is no particular problem or disadvantage to be encountered when they are confined. They must be fed a complete ration, but that will be required whether they are confined or not, if they are to yield the best returns.

A PRACTICAL PLAN

A good plan is to secure pullets ready for summer range, or brood the chicks indoors, develop the pullets on range used exclusively for that purpose. Then confine the pullets when they are ready to lay to wire sun parlors or sun yards, so they will not come in contact with the soil. The pullet range then would never be contaminated by mature birds. It would have part of the year to become reconditioned. The range should be large enough so the housing quarters can be moved to different sections so as not to use the same area two years in succession.

By use of suitable summer range shelters (plans furnished on request), Figure 7, and the feeding of the birds some distance from the roosting quarters, the droppings will be distributed over a wide area and no part of the range should become bare and dangerously

contaminated. This can be effectively accomplished by moving the range shelters, which is a simple matter; and gradually moving the feed and water away from roosting quarters 10 to 20 feet daily, until the pullets spend practically all the day 500 to 1,500 feet away from the roosting quarters, and return to roost at night, Figure 8. This plan carefully followed, and if at the same time, the other essential requirements have been met, should in most cases yield pullets ready to lay in the fall and comparatively free from disease and parasites.

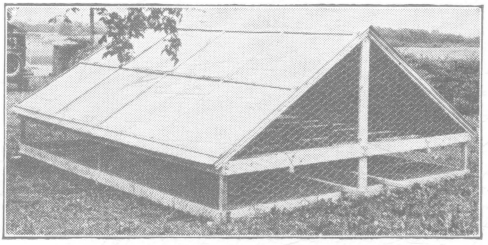

Fig. 7.—A portable summer range shelter for pullets. Two men may carry it to a fresh location. Such shelters will often simplify the summer range problem, which should result in better quality pullets. The material cost of this shelter is about $20.

The third and final phase of this plan of management, is to transfer the pullets to the laying house, where they will be confined and never permitted outside again, except in a wire screen sun parlor or a sun yard. This applies more particularly to layers for market egg production. Just how the breeders will be managed in this connection, constitutes another phase of the problem yet to be approached, altho there are indications that the breeders may be successfully managed in the same way.

This plan of management should simplify present range problems and difficulties. Perhaps the most important advantage of the plan is that the range would never be frequented by mature birds, which are often the most dangerous carriers of disease and intestinal parasites. Is there a more simple and effective solution of the range problem for the farm poultry keeper?

Finally, the question is yet to be answered, shall the chickens be confined? It seems there may be two answers; Yes, for commercial poultry keepers, because there is hardly any alternative for them if they are to make the chicken business a profitable, large-scale commercial enterprise; Yes and No, for the farm poultry keeper. If serious trouble is being experienced with coccidiosis, tuberculosis, or intestinal parasites, or other difficulties arising from a contaminated range, and if the poultryman is in position to feed and manage the birds in accordance with their more exacting requirements when confined, then it may prove the most effective

solution of his difficulties. On the other hand, since there are certain difficulties and disadvantages attending confinement of chickens, the farm poultry keeper who is succeeding with brooding the chicks, and developing the pullets on the range, and even permitting the layers to run at large, would have little, if anything, to gain, and perhaps much to lose by confining them.

Fig. 8.—The birds below spend most of the day a considerable distance from the roosting quarters, where the range conditions are much better, because the feeding and drinking equipment is moved to a fresh location before sanitary conditions become dangerous. Contrast this procedure with the faulty management above when the birds are concentrated close to the houses on bare contaminated ground, which often leads to disaster.